DANA SPICER®
Off-Highway Products

Service Manual

700/211 Axle

ASM–0204E
September 2015

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INTRODUCTION

The efficiency and continued operation of mechanical units depend on constant, correct maintenance and also on efficient repair work, should there be a break-down or malfunction. The instructions contained in this manual have been based on a complete overhaul of the unit. However, it is up to the mechanic to decide whether or not it is necessary to assemble only individual components, when partial repair work is needed. The manual provides a quick and sure guide which, with the use of photographs and diagrams illustrating the various phases of the operations, allows accurate work to be performed.All the information needed for correct disassembly, checks and assembly of each individual component is set out below. In order to remove the differential unit from the vehicle, the manuals provided by the vehicle manufacturer should be consulted. In describing the following operations it is presumed that the unit has already been removed from the vehicle.

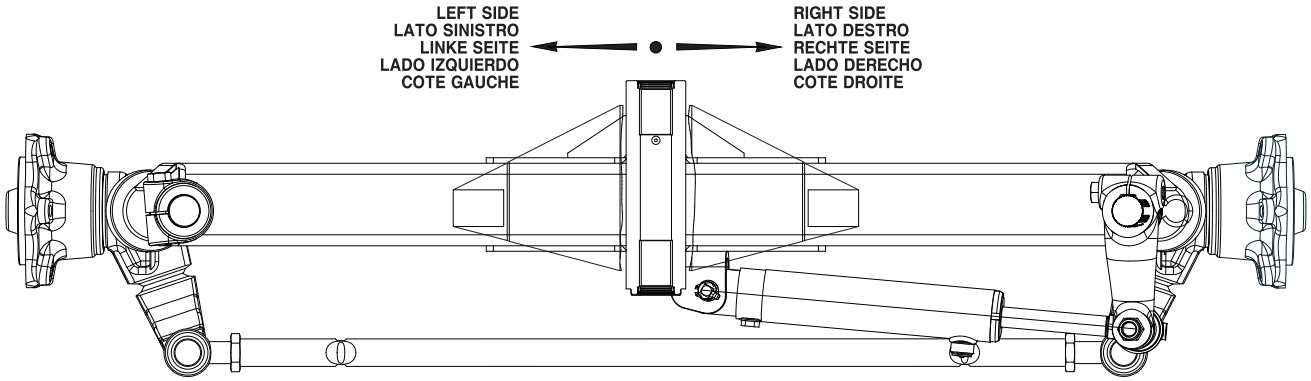
IMPORTANT: In order to facilitate work and protect both working surfaces and operators, it is advisable to use proper equipment such as: trestles or supporting benches, plastic or copper hammers, appropriate levers, pullers and specific spanners or wrenches. Before going on to disassemble the parts and drain the oil, it is best to thoroughly clean the unit, removing any encrusted or accumulated grease.

INTRODUCTORY REMARKS: All the disassembled mechanical units should be thoroughly cleaned with appropriate products and restored or replaced if damage, wear, cracking or seizing have occurred. In particular, thoroughly check the condition of all moving parts (bearings, gears, crown wheel and pinion, shafts) and sealing parts (O-rings, oil shields) which are subject to major stress and wear. In any case, it is advisable to replace the seals every time a component is overhauled or repaired. During assembly, the sealing rings must be lubricated on the sealing edge. In the case of the crown wheel and pinion, replacement of one component requires the replacement of the other one. During assembly, the prescribed pre-loading, backlash and torque of parts must be maintained.

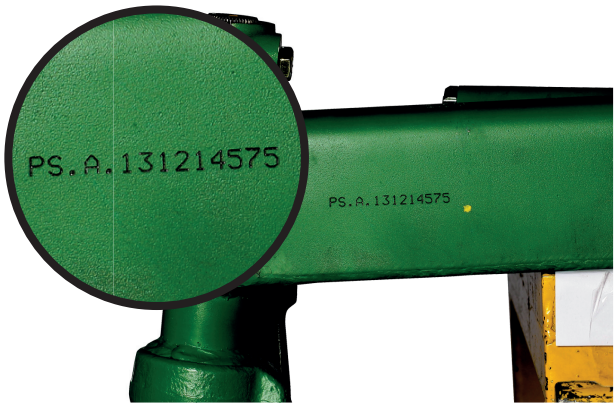
SPECIFIC EQUIPMENT AND SPARE PARTS: The drawings of all specific tools required for maintenance and repair work can be found at the end of this manual ; spare parts may be ordered either from the vehicle manufacturer or directly from the Service Centers or Authorized Distributors of Dana Holding.

MAINTENANCE & LUBRICATION

DEFINITION OF VIEWPOINTS



DATA PLATE



1 - Model number

2 - Serial number

3 - Axle number

CONVERSION TABLES

UNITS OF PRESSURE

	Atm	Bar	MPa	Pa	PSI
Atm	1	1	0,1	10^5	14,4
Bar	1	1	0,1	10^5	14,4
MPa	10	10	1	10^6	144
Pa	0,00001	0,00001	10^{-6}	1	-
PSI	-	-	-	-	1

UNIT OF WEIGHT

	N	daN	kN	kg	lbs
1N	1	0,1	0,001	0,102	0,225
1daN	10	1	0,01	1,02	2,25
1kN	1000	100	1	102	225
1kg	9,81	0,981	0,00981	1	2,205

UNITS OF TORQUE

	N·m	daN·m	kN·m	kg·m	lb·in
1N·m	1	0,1	0,001	0,102	8,854
1daN·m	10	1	0,01	1,02	88,54
1kN·m	1000	100	1	102	8854
1kg·m	9,81	0,981	0,00981	1	86,8
1 lb·in	0,1129	0,01129	0,0001129	0,01152	1

TORQUE SPECIFICATIONS

COARSE PITCH

SIZE OF BOLT	TYPE OF BOLT					
	8.8	8.8 + Loctite 270	10.9	10.9 + Loctite 270	12.9	12.9 + Loctite 270
M6 x 1 mm	9,5 – 10,5 N·m	10,5 – 11,5 N·m	14,3 – 15,7 N·m	15,2 – 16,8 N·m	16,2 – 17,8 N·m	18,1 – 20 N·m
M8 x 1,25 mm	23,8 – 26,2 N·m	25,6 – 28,4 N·m	34,2 – 37,8 N·m	36,7 – 40,5 N·m	39 – 43 N·m	43,7 – 48,3 N·m
M10 x 1,5 mm	48 – 53 N·m	52 – 58 N·m	68 – 75 N·m	73 – 81 N·m	80 – 88 N·m	88 – 97 N·m
M12 x 1,75 mm	82 – 91 N·m	90 – 100 N·m	116 – 128 N·m	126 – 139 N·m	139 – 153 N·m	152 – 168 N·m
M14 x 2 mm	129 – 143 N·m	143 – 158 N·m	182 – 202 N·m	200 – 221 N·m	221 – 244 N·m	238 – 263 N·m
M16 x 2 mm	200 – 221 N·m	219 – 242 N·m	283 – 312 N·m	309 – 341 N·m	337 – 373 N·m	371 – 410 N·m
M18 x 2,5 mm	276 – 305 N·m	299 – 331 N·m	390 – 431 N·m	428 – 473 N·m	466 – 515 N·m	509 – 562 N·m
M20 x 2,5 mm	390 – 431 N·m	428 – 473 N·m	553 – 611 N·m	603 – 667 N·m	660 – 730 N·m	722 – 798 N·m
M22 x 2,5 mm	523 – 578 N·m	575 – 635 N·m	746 – 824 N·m	817 – 903 N·m	893 – 987 N·m	974 – 1076 N·m
M24 x 3 mm	675 – 746 N·m	732 – 809 N·m	950 – 1050 N·m	1040 – 1150 N·m	1140 – 1260 N·m	1240 – 1370 N·m
M27 x 3 mm	998 – 1103 N·m	1088 – 1202 N·m	1411 – 1559 N·m	1539 – 1701 N·m	1710 – 1890 N·m	1838 – 2032 N·m
M30 x 3,5 mm	1378 – 1523 N·m	1473 – 1628 N·m	1914 – 2115 N·m	2085 – 2305 N·m	2280 – 2520 N·m	2494 – 2757 N·m

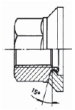
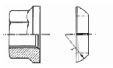
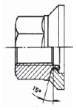
FINE PITCH

SIZE OF BOLT	TYPE OF BOLT					
	8.8	8.8 + Loctite 270	10.9	10.9 + Loctite 270	12.9	12.9 + Loctite 270
M8 x 1 mm	25,7 – 28,3 N·m	27,5 – 30,5 N·m	36,2 – 39,8 N·m	40 – 44 N·m	42,8 – 47,2 N·m	47,5 – 52,5 N·m
M10 x 1,25 mm	49,4 – 54,6 N·m	55,2 – 61 N·m	71,5 – 78,5 N·m	78 – 86 N·m	86 – 94 N·m	93 – 103 N·m
M12 x 1,25 mm	90 – 100 N·m	98 – 109 N·m	128 – 142 N·m	139 – 154 N·m	152 – 168 N·m	166 – 184 N·m
M12 x 1,5 mm	86 – 95 N·m	94 – 104 N·m	120 – 132 N·m	133 – 147 N·m	143 – 158 N·m	159 – 175 N·m
M14 x 1,5 mm	143 – 158 N·m	157 – 173 N·m	200 – 222 N·m	219 – 242 N·m	238 – 263 N·m	261 – 289 N·m
M16 x 1,5 mm	214 – 236 N·m	233 – 257 N·m	302 – 334 N·m	333 – 368 N·m	361 – 399 N·m	394 – 436 N·m
M18 x 1,5 mm	312 – 345 N·m	342 – 378 N·m	442 – 489 N·m	485 – 536 N·m	527 – 583 N·m	580 – 641 N·m
M20 x 1,5 mm	437 – 483 N·m	475 – 525 N·m	613 – 677 N·m	674 – 745 N·m	736 – 814 N·m	808 – 893 N·m
M22 x 1,5 mm	581 – 642 N·m	637 – 704 N·m	822 – 908 N·m	903 – 998 N·m	998 – 1103 N·m	1078 – 1191 N·m
M24 x 2 mm	741 – 819 N·m	808 – 893 N·m	1045 – 1155 N·m	1140 – 1260 N·m	1235 – 1365 N·m	1363 – 1507 N·m
M27 x 2 mm	1083 – 1197 N·m	1178 – 1302 N·m	1520 – 1680 N·m	1672 – 1848 N·m	1834 – 2027 N·m	2000 – 2210 N·m
M30 x 2 mm	1511 – 1670 N·m	1648 – 1822 N·m	2138 – 2363 N·m	2332 – 2577 N·m	2565 – 2835 N·m	2788 – 3082 N·m

TORQUE SPECIFICATIONS

WHEEL NUT TIGHTENING TORQUES

Wheel nut tightening torques recommended from rim's O.E.M. with reference to the quality of the rim's material.

WHEEL NUT TIGHTENING TORQUES				
CHARACTERISTICS	ILLUSTRATION	WHEEL STUD THREAD	RECOMMENDED WHEEL NUTS TORQUE	
			RIM MATERIAL QUALITY	
			ST 37	**ST 52
WHEEL NUTS WITH INTEGRATE SPHERICAL COLLAR		M18 x 1,5 mm	330 N·m	460 N·m
		M20 x 1,5 mm	490 N·m	630 N·m
		M22 x 1,5 mm	630 N·m	740 N·m
FLAT COLLAR WHEEL NUTS WITH SEPARATE SPHERICAL LOCK WASHER		M18 x 1,5 mm	270 N·m	360 N·m
		M20 x 1,5 mm	360 N·m	450 N·m
		M22 x 1,5 mm	460 N·m	550 N·m
WHEEL NUTS WITH INTEGRATE SEAT CAPTIVE WASHER		M18 x 1,5 mm	260 N·m	360 N·m
		M20 x 1,5 mm	350 N·m	500 N·m
		M22 x 1,5 mm	450 N·m	650 N·m

****RIM MATERIAL ST 52 IS RECOMMENDED BY DANA ON AXLE APPLICATIONS. IT IS THE OPTIMUM MATERIAL FOR TIGHTENING THE RIM TO THE HUB.**

NOTE:

The wheel nut tightening torque is related only on nut thread and stud thread dry (without oil or any lubricant).

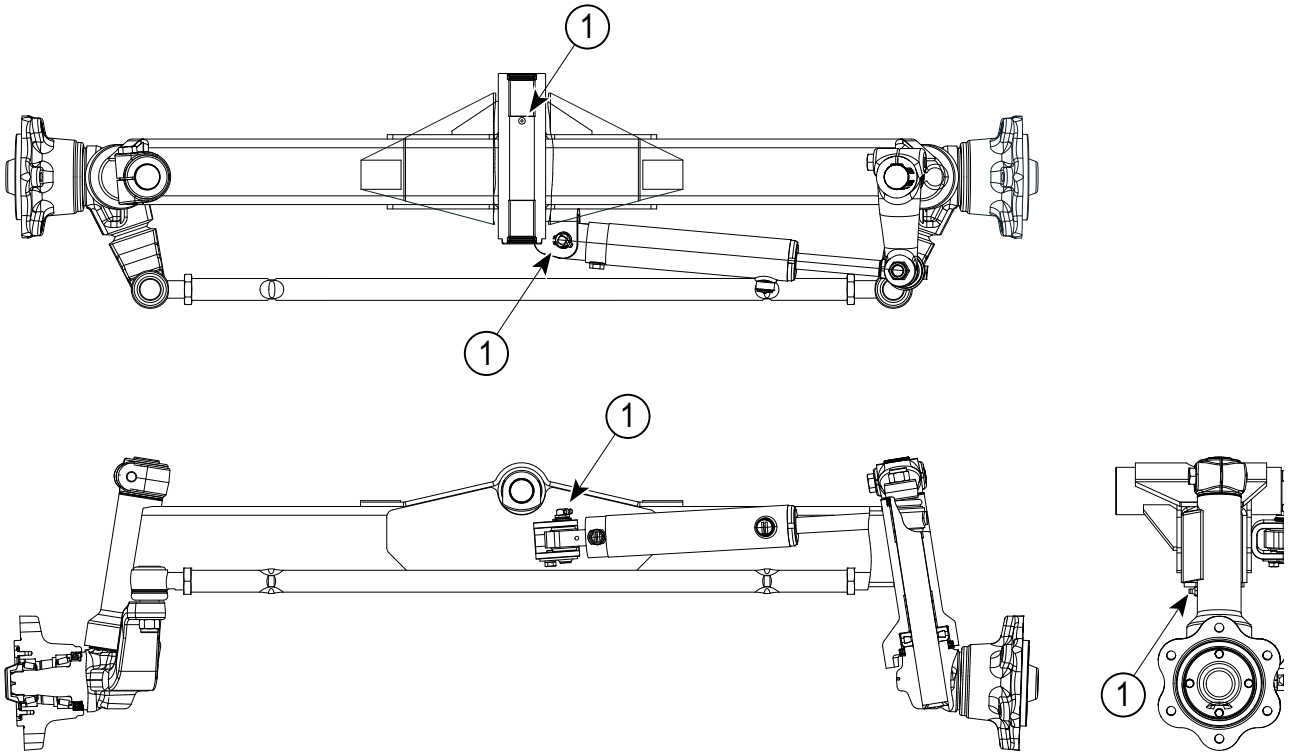
NOTE:

The wheel nut tightening torque takes into consideration not only the nut + stud characteristics, but also the quality of the rim material.

THE DANA OFFICIAL TIGHTENING TORQUE TABLE, INCLUDED IN EACH SERVICE MANUAL, SHOWS THE TORQUE FIGURE RELATED TO THE BOLT CHARACTERISTIC ONLY .		
DANA OFFICIAL TIGHTENING TORQUE TABLE		
NUT MATERIAL QUALITY 8.8 & 10.9	STUD MATERIAL QUALITY 10.9	*TORQUE RANGE
M18 x 1,5 mm	M18 x 1,5 N·m	442 - 489 N·m
M20 x 1,5 mm	M20 x 1,5 N·m	613 - 677 N·m
M22 x 1,5 mm	M22 x 1,5 N·m	822 - 908 N·m

***THE TORQUE FIGURE ON NUT AND STUD COUPLING MUST BE RELATED ON STUD MATERIAL QUALITY (DANA AXLES ARE 10.9 ONLY).**

MAINTENANCE POINTS



1 - Grease zerk

MAINTENANCE INTERVALS

GREASING FREQUENCY

In the axle assembly four greasing points have been provided at following parts

2 nos. on kingpin, 1 no. on center pivot tube & 1 no on cylinder fixing pin.

Wheel hub assembly is protected with a cassette seal, which is not to be greased externally.

FOLLOWING GREASING FREQUENCY IS RECOMMENDED

For Pudding Field: Greasing is required to do externally after every 10 hrs of paddy operation at all greasing points.

For Dry /Normal Field: Greasing is required to do externally once in 100 hrs of tractor operation at all greasing points.

Do not take out the hub. But if some impurities or improper hub rotation observed, then disassemble the wheel hub.

It should be noted that once hub is removed from wheel end assembly, cassette seal must be replaced with the new cassette seal as it gets damaged once disassembled. Also once kingpin seals are removed from their position, they get damaged while removing & hence they must be replaced.

LUBRICANT & SEALANT SPECIFICATIONS

1 - Locking, sealing and lubricating materials referred to in this manual are the same used in the shop-floor.

2 - The table below gives an account of the typical applications of each single material, in order to facilitate replacement with similar products marketed by different brand names with different trade marks.

LOCTITE 242

Anaerobic product apt to prevent the loosening of screws, nuts and plugs. Used for medium-strength locking. Before using it, completely remove any lubricant by using the specific activator.

LOCTITE 243

The oleocompatible alternative to 242. Does not require the activation of lubricated surfaces.

LOCTITE 270

Anaerobic product for very-high strength locking of screws and nuts. Before using it, completely remove any lubricant by using the specific activator.

To remove parts, it may be necessary to heat them at 80°C approximately.

LOCTITE 275

Anaerobic product suitable for high-strength locking and sealing of large threaded parts, bolts and stud bolts, for pipe sealing and for protecting parts against tampering; suitable for sealing coupling surfaces with a maximum diametrical clearance of 0.25 mm.

LOCTITE 512

Anaerobic product for the hermetic sealing of flanged units and screw holes communicating with fluids. Can seal clearances between flanges up to 0.2 mm.

LOCTITE 577

Quick anaerobic sealant for sealing threaded portions of conical or cylindrical unions up to M80. Before using it, remove any lubricant with the specific activator. After polymerisation, disassembly may result rather difficult, so heating may be necessary for larger diameters.

LOCTITE 638

Anaerobic adhesive for fast and high-strength gluing of cylindrical metal joints (hub on shaft). Can glue together parts with clearance ranging between 0.1 and 0.25 mm.

LOCTITE 648

Anaerobic adhesive for fast and medium-strength gluing of cylindrical metal joints (hub on shaft). Can glue together parts with radial clearance below 0.1 mm.

AREXONS (REPOSITIONABLE JOINTING COMPOUND FOR SEALS)

Solvent-based sealing compound for elastic seals, drying through evaporation. Used for sealing the outer diameter of sealing rings for rotating shafts with outer metal reinforcement.

SILICONE

Semi-fluid adhesive material used for sealing and filling and to protect components from environmental and physical elements. Polymerises with non-corrosive dampness.

TECNO LUBE/101 (SILICONE-BASED GREASE)

Highly adhesive synthetic grease, with silicone compounds added.

Applied to adjustment screws with hole communicating with oil-type fluids.

Used when frequent adjusting is required.

MOLIKOTE (DOW CORNING)

Lubricating compound containing molybdenum disulphide, used to lubricate articulation pins and to prevent sticking and oxidation of parts that are not lubricated on a regular basis.

(LITHIUM-BASED) GREASE

Applied to bearings, sliding parts and used to lubricate seals or parts during assembly.

SAFETY PRECAUTIONS

1 - During all operations described in this manual, the axle should be fastened onto a trestle, while the other parts mentioned should rest on supporting benches.

2 - When removing one of the arms, an anti-tilting safety trestle should be placed under the other arm.

3 - When working on an arm that is fitted on the machine, make sure that the supporting trestles are correctly positioned and that the machine is locked lengthways.

4 - Do not admit any other person inside the work area; mark off the area, hang warning signs and remove the ignition key from the machine.

5 - Use only clean, quality tools; discard all worn, damaged, lowquality or improvised wrenches and tools. Ensure that all torque wrenches have been checked and calibrated.

6 - Always wear gloves and non-slip rubber shoes when performing repair work.

7 - Should you stain a surface with oil, remove marks straight away.

8 - Dispose of all lubricants, seals, rags and solvents once work has been completed. Treat them as special waste and dispose of them according to the relative law provisions obtaining in the country where the axles are being overhauled.

9 - Make sure that only weak solvents are used for cleaning purposes; avoid using turpentine, dilutants and toluol, xylolbased or similar solvents; use light solvents such as Kerosene, mineral spirits or water-based, environment friendly solvents.

10 - For the sake of clarity, the parts that do not normally need to be removed have not been reproduced in some of the diagrams.

11 - For agricultural axles, the terms RIGHT and LEFT refer to the position from the operator's seat. For construction axles, the terms RIGHT and LEFT refer to the position outside facing the machine (with the input drive facing forward)

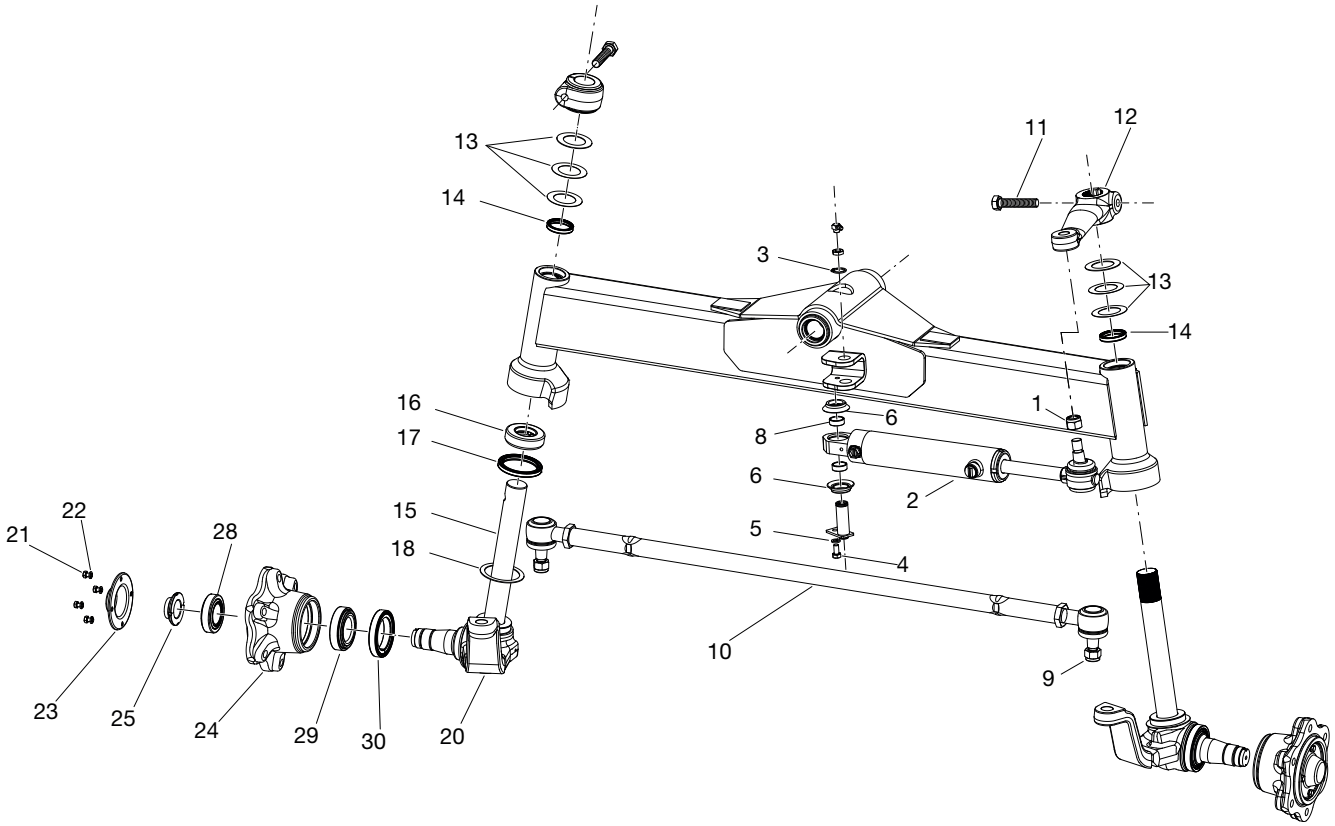
12 - After repair work has been completed, accurately touch up any coated part that may have been damaged.

13 - Follow all safety instructions in the Original Equipment Manufacturer (OEM) manual that came with the vehicle.

⚠DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠WARNING	Indicates an imminently hazardous situation which, if not avoided, could result in death or serious injury.
⚠CAUTION	Indicates a situation which, if not avoided, may result in damage to components.
NOTICE	Indicates information which may make product service easier to perform.

STEERING KNUCKLE

EXPLODED VIEW



DISASSEMBLY

FIGURE 1: Remove the cylinder nut (1).

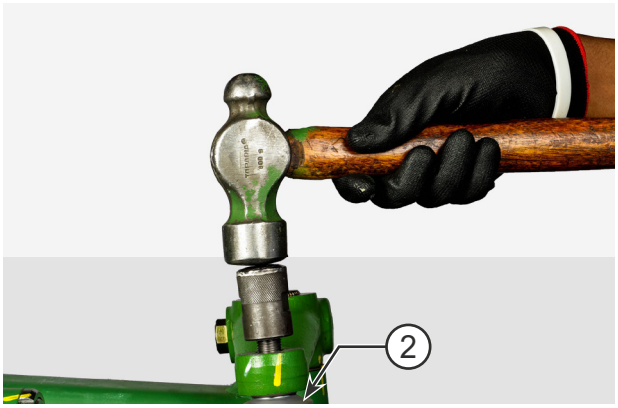


FIGURE 2: Disconnect the tapered pins of the cylinder (2) from the steering knuckle using a suitable diameter driver.

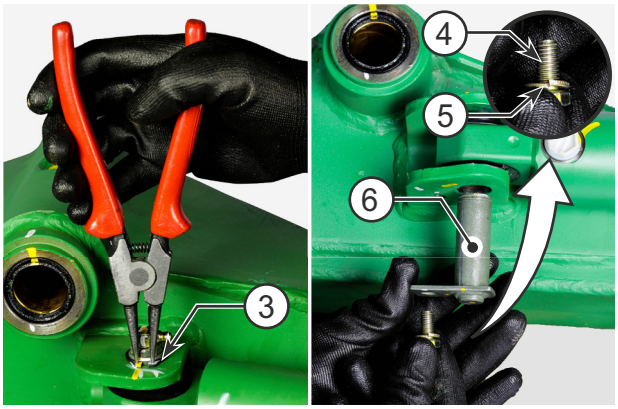


FIGURE 3: Loosen and remove the grease zerk. Remove the snap ring (3), the capscrew (4) and the steering cylinder pin (6).

⚠WARNING

Personal injury can result when removing snap ring.
The appropriate safety equipment must be worn.
To avoid injury to your eyes, wear protective glasses during this procedure.

FIGURE 4: Extract the cylinder (2) using a plastic hammer. Remove the two spacers (8) and the two seals (6)

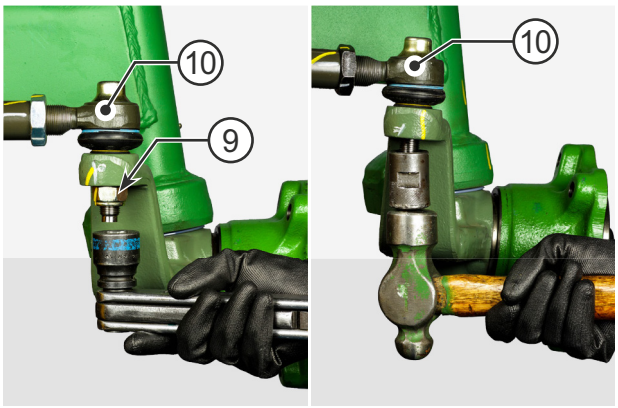


FIGURE 5: Remove the tie rod nuts (9).
Disconnect the tapered pins of the tie rod (10) using a puller.

FIGURE 6: Loosen and remove the hex screw (11) complete with locker (12) and spacer (13).
Remove the complete steering knuckle (20).

⚠CAUTION

Removing the capscrew (11) the steering case could come out from its seat, support the steering knuckle (20) with a suitable lifting device.

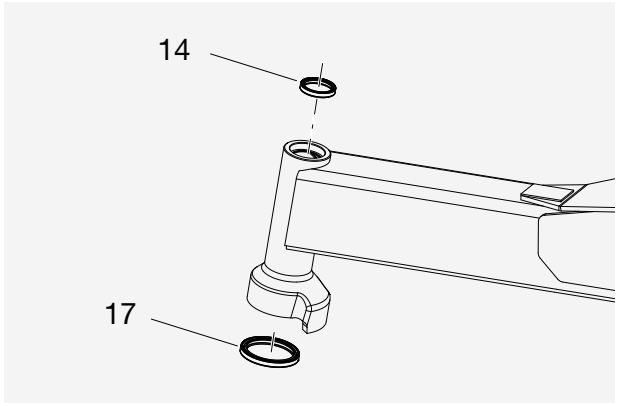


FIGURE 7: Using an internal extractor, remove the seal rings (14, 17) from the axle.

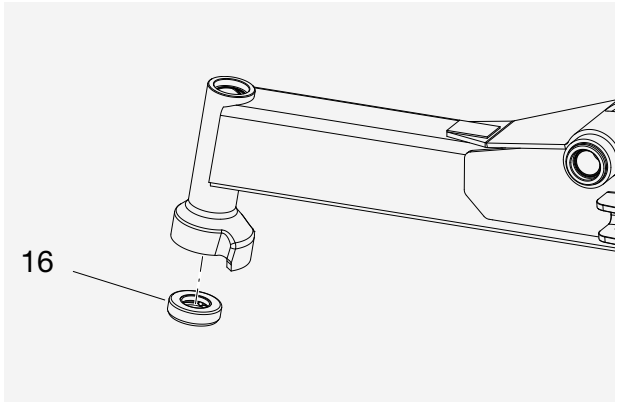


FIGURE 8: Using an internal extractor, remove the bearing (16) from the axle.

FIGURE 9: Using an internal extractor, remove the bushings from the axle.

FIGURE 10: Loosen and remove the screws (21) and the cover (23).

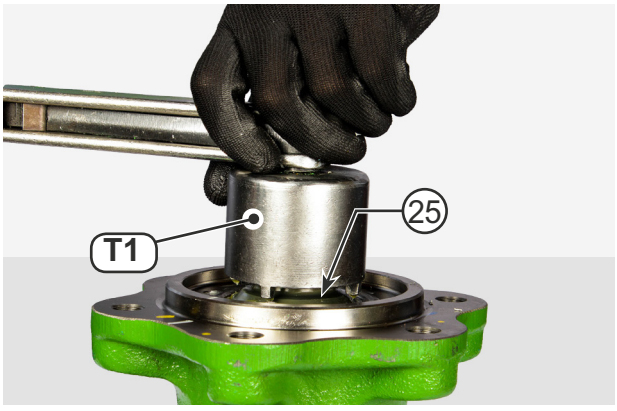


FIGURE 11: Using special tool T1 (see drawing T1 p. 31), remove the ring nut (25).

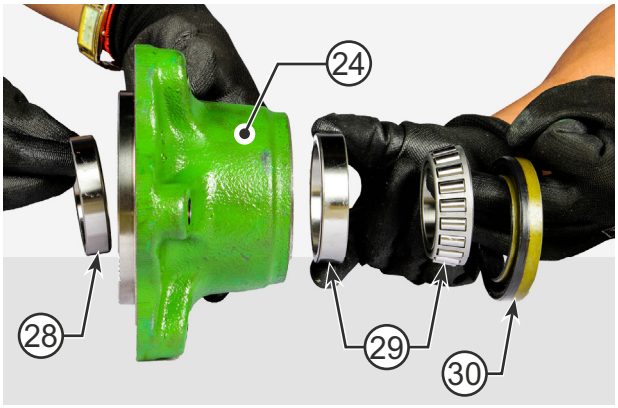


FIGURE 12: Disassemble wheel hub (24) components:
Outer bearing (28)
Inner bearing (29)
Seal ring (30).

ASSEMBLY

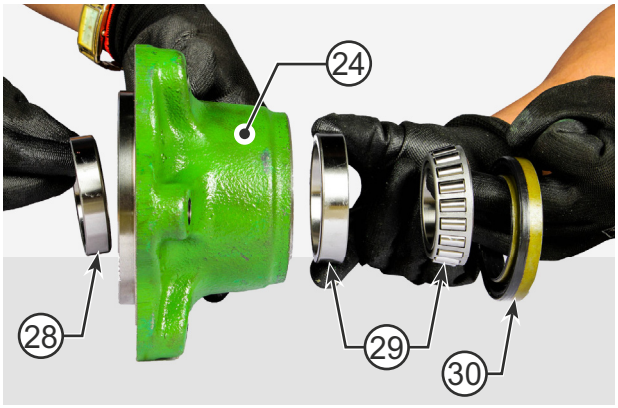


FIGURE 13: Using a press and suitable tools (see drawings T2 p. 32 and T3 p. 32) install wheel hub (24) components:
Outer bearing (28)
Inner bearing (29)
Seal ring (30).

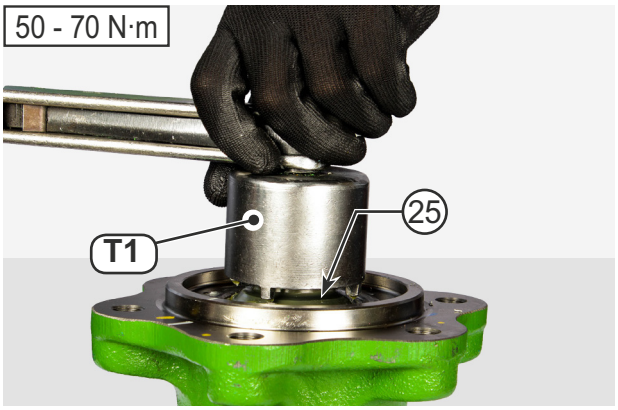


FIGURE 14: Install the ring nut (25), and using the special tool T1 (see drawing T1 p. 31), tighten to a torque of 50 - 70 N·m.

FIGURE 15: Spread the cover with Anabond sealant 676 or equivalent.

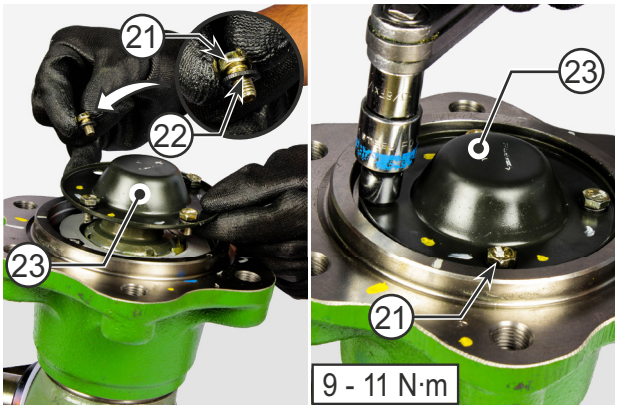


FIGURE 16: Install the cover in its seat, and tighten the capscrews (21) complete with washers (22) to a torque of 9 - 11 N·m.

FIGURE 17: Using special tool T6 (see drawing T6 p. 35), install the bushings in their seats.

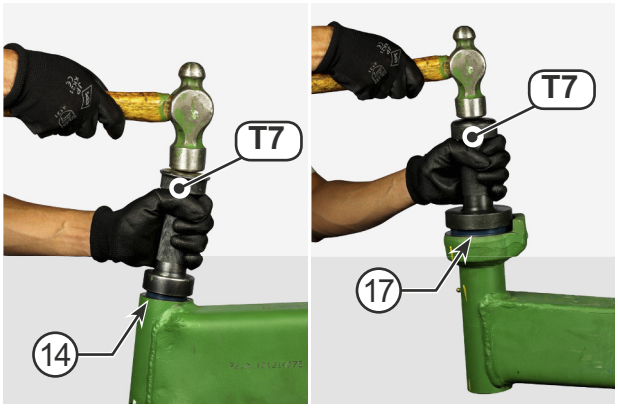


FIGURE 18: Using special tool T7 (see drawing T7 p. 35), install the seal rings (14, 17) in their seats.

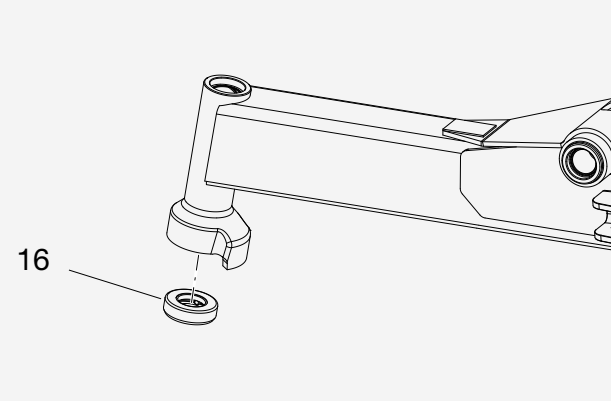


FIGURE 19: Install the bearing (16) in its seat.

MISSING IMAGE

FIGURE 20: Prepare a series of shims (13) of 2.5 mm to be assembled under the locker.

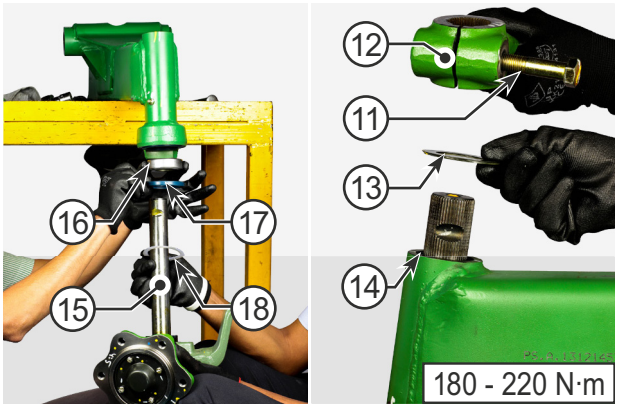


FIGURE 21: Install the steering knuckle (20).
Install the spacer (13) and the locker (12).
Tighten the screw (11) to a torque of 180 - 220 N·m.

⚠CAUTION

Pay attention not to damage the sealing rings.

MISSING IMAGE

FIGURE 22: Check vertical gap using a lever.
King pin Preload Draw = 0,1 - 0,3 mm
S = First step shim - Measured Backlash - Preload Draw =
Example
First step Shim = 2.5 mm
Measured Backlash = 1 mm
S = 2.5 mm - 1 mm - 0,2 mm = 1,3 mm
S = 1,3 mm

FIGURE 23: Insert the tie rod pins in the steering knuckle (20) and lock nuts (9) into position using a torque of 120 - 130 N·m.

FIGURE 24: Install the two spacers (8) and the two seals (6)
Fit the steering cylinder (2) into its seat.

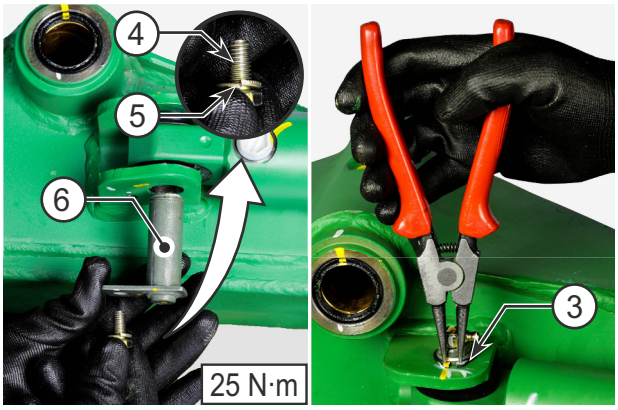


FIGURE 25: Install the steering cylinder pin (6), and tigten the capscrew (4) to a torque of 25 N·m.
Install the snap ring (3) in its seat.

⚠WARNING

Personal injury can result when removing snap ring.
The appropriate safety equipment must be worn.
To avoid injury to your eyes, wear protective glasses during this procedure.

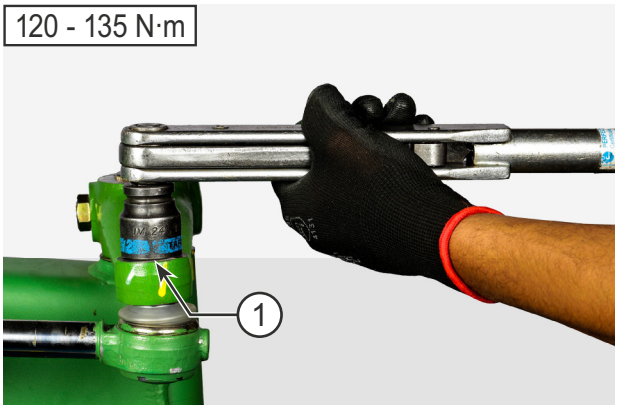
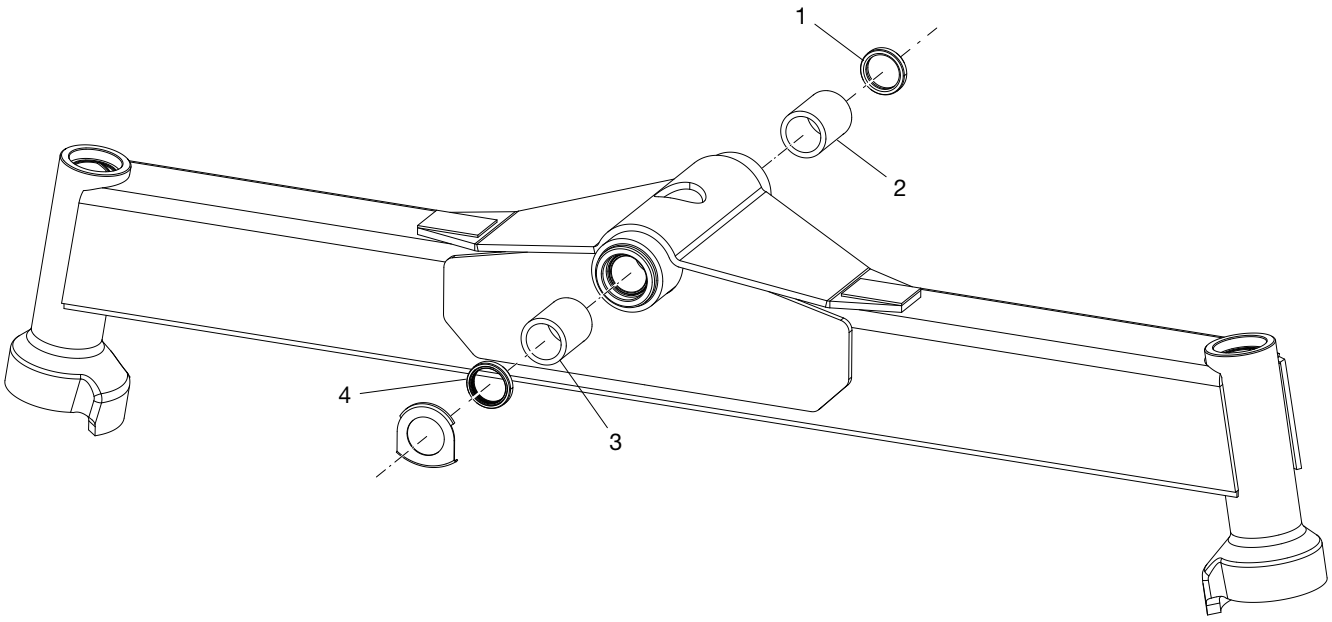


FIGURE 26: Insert the cylinder rod in the steering knuckle (20) and lock nuts (9) into position using a torque of 120 - 135 N·m.

TRUNNION

EXPLODED VIEW



DISASSEMBLY

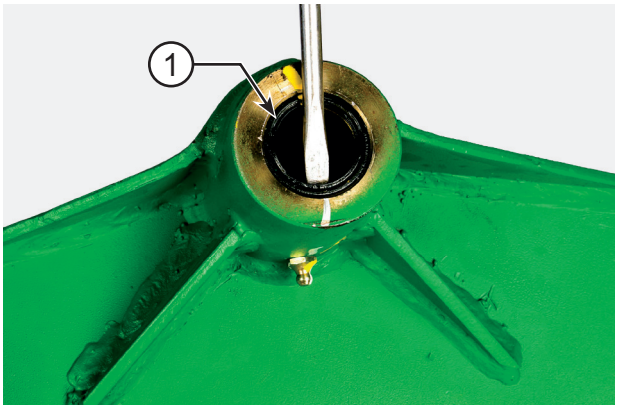


FIGURE 1: Using a screwdriver, remove the seal rings (1, 4) from their seats.

⚠CAUTION

Be careful to not damage the seats.

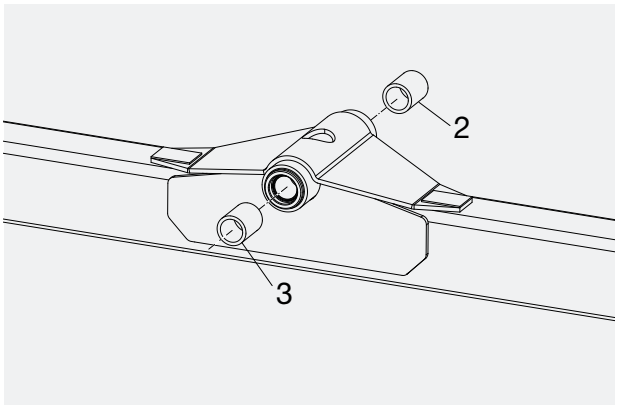


FIGURE 2: Using an internal extractor, remove the bushings (2, 3) from their seats.

⚠CAUTION

Be careful to not damage the seats.

ASSEMBLY

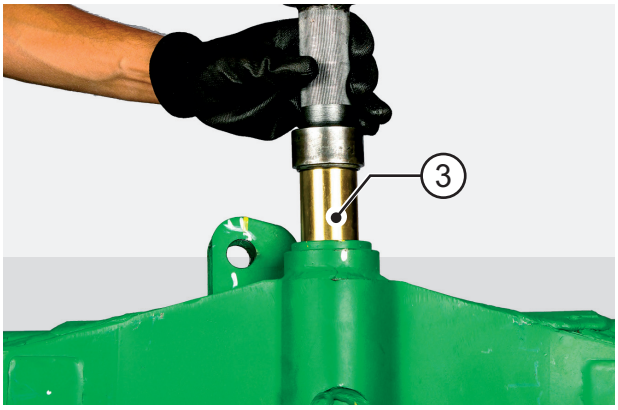


FIGURE 3: Using special tool T4 (see drawing T4 p. 33), install the bushings (2, 3).

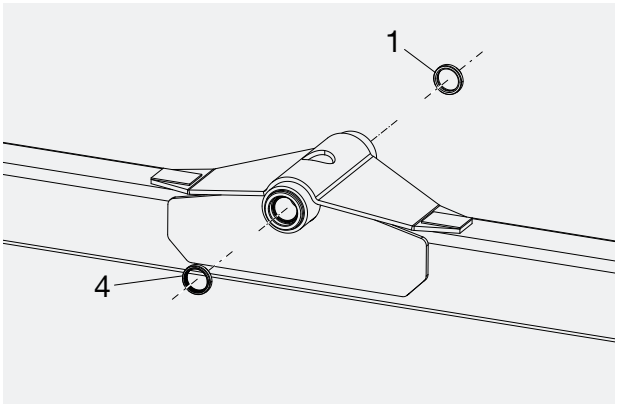


FIGURE 4: Using special tool T5 (see drawing T5 p. 34), install the sealing rings (1, 4).

⚠CAUTION

Assemble in correct position.

TOE-IN

ADJUSTMENT

1 - Supporting the axle with a hoist and install axle into vehicle. Install front wheels.

NOTE:

The toe-in adjustment must be performed on the vehicle.

2 - Jack up front axle so tires are off floor.

3 - Rotate tire by hand and scribe a line near the center of each of the front tires.

NOTE:

One of the tie rod ends and jam nut has left-hand threads.

4 - Measure and record the distance between the lines at the front and the rear of the tire at about axle height. The front measurement should be less than the rear measurement.

5 - If measurement is not correct, loosen jam nuts on both ends of tie rod and turn the tie rod using a wrench to increase or decrease the amount of toe until the measured dimension is 0–0.125 in. [0–2 mm] between the front and rear.

6 - Apply Loctite 262 and tighten the jam nuts to 85–96 lbs. ft. [200– 220 N•m].

TROUBLESHOOTING

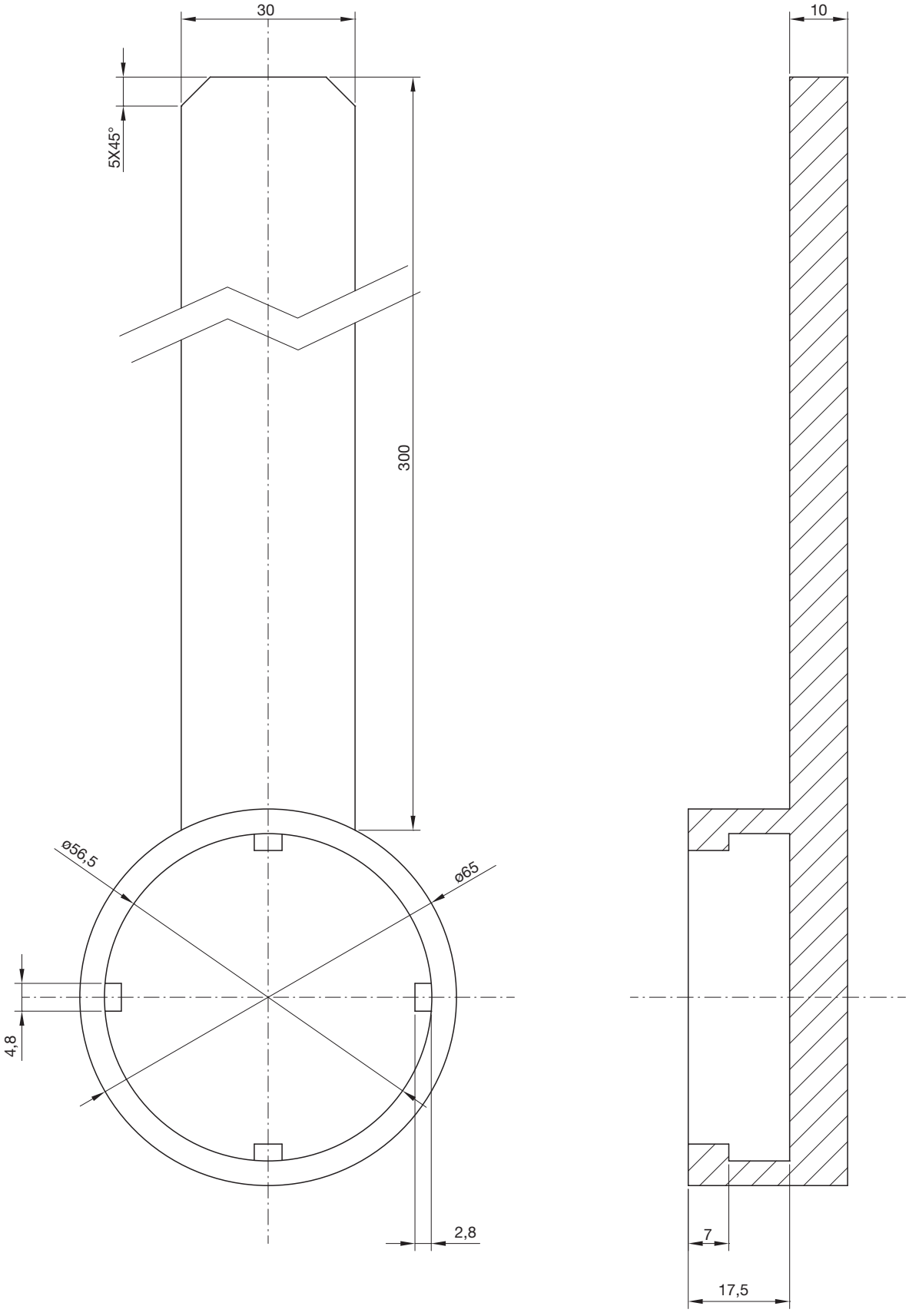
SNO.	CONDITION	POSSIBLE CAUSES	REMEDY
1)	Excessive Wheel Wobbling	Wheel Hub bearing preload not correct.	Check the preload, bearing condition.
		Bearing failure, Oil seal failure.	Replace the bearing, ring nut and Seals.
		Excessive king pin radial play.	Replace the bushes, kingpin bottom and top seal
		Excessive play in drop arm.	Adjust the endplay.
2)	Hitting Noise from front axle support	Center tube thrust washer worn out.	Replace the thrust washer.
		Excessive play in center tube bushes, worn out bushes	Replace the bush and seals
3)	Hitting noise from kingpin side	Excessive axial float in king pin tube.	Replace the Kingpin thrust washer of required thickness
4)	Incorrect Steering function	Ball joint failure	Replace the ball joints.
		Incorrect toe-in	Adjust the toe-in setting.

NOTE:

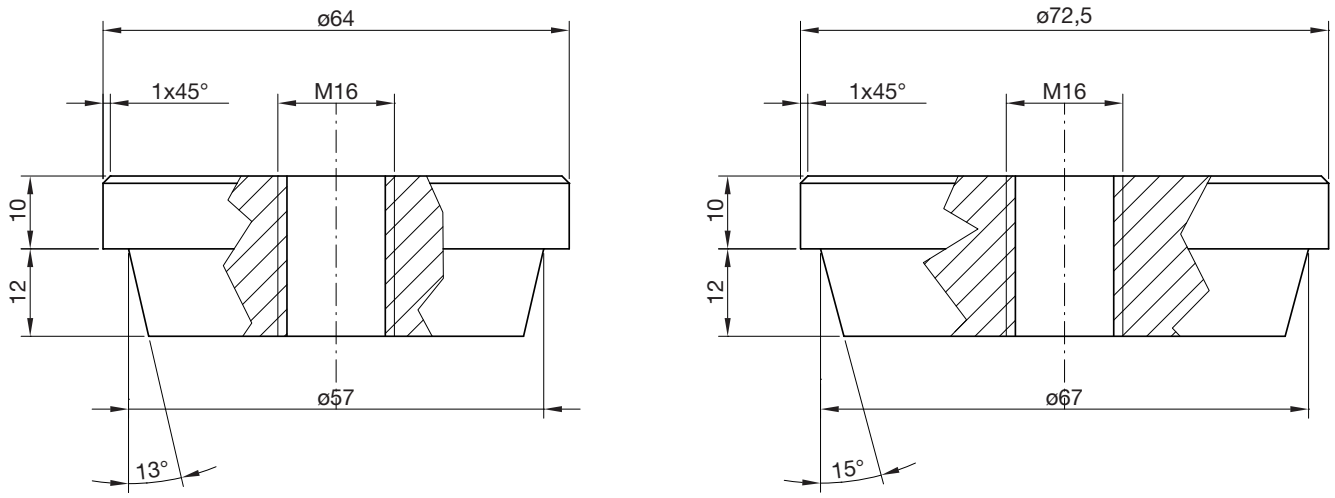
If in doubt please contact authorized person for more details and clarifications.

Continuous improvement is always a part of process, please refer proper documents for better results.

T1



T2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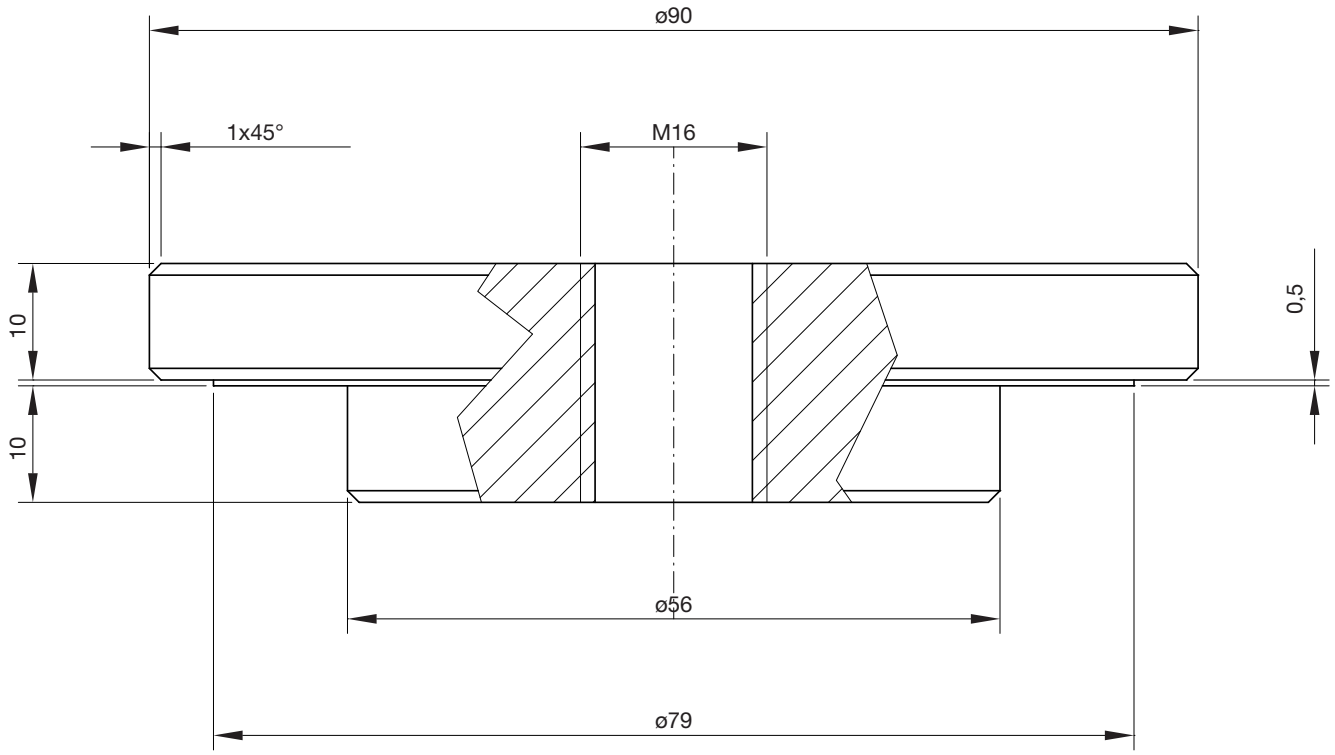
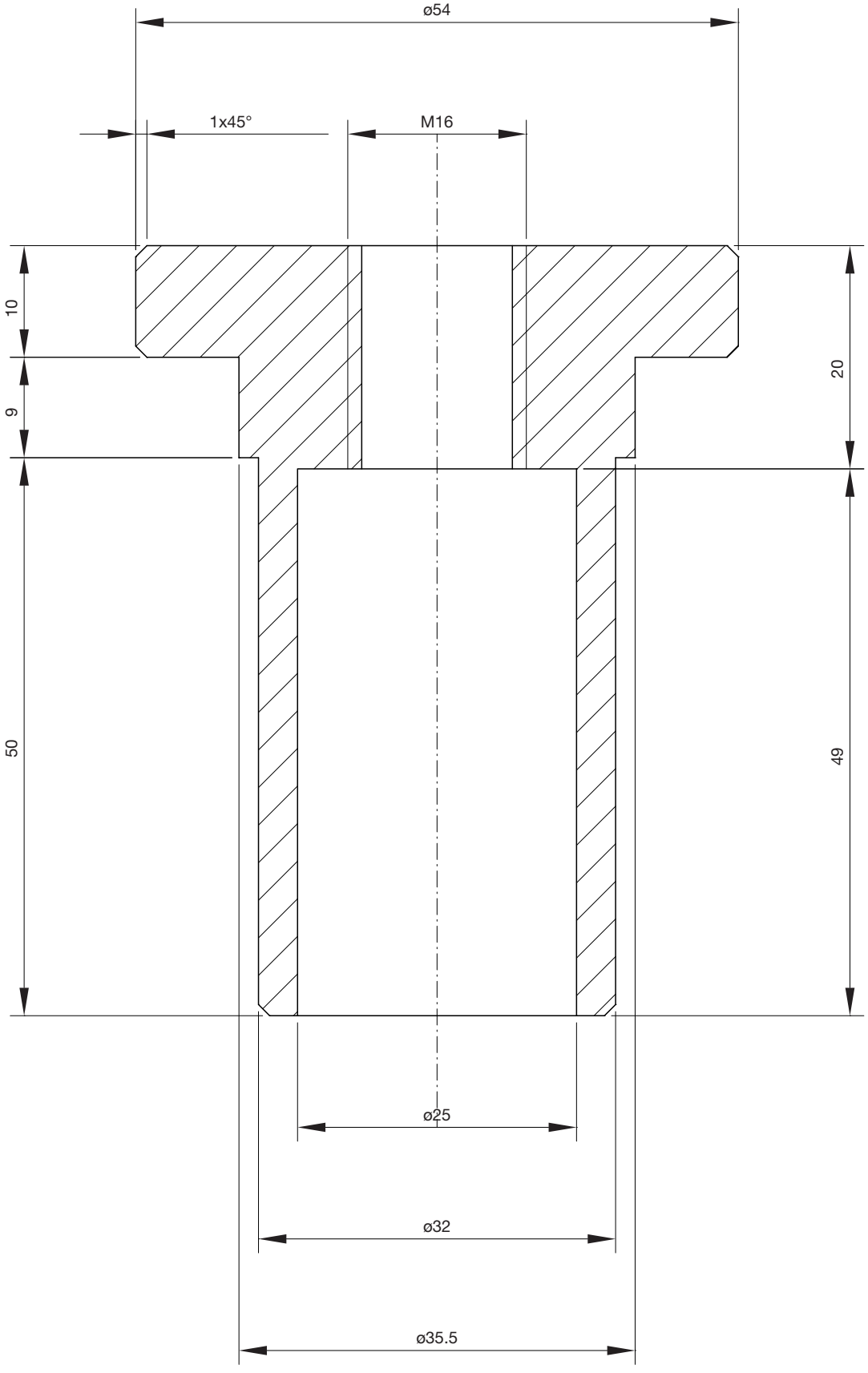
M16
10
12
ø57
13°
ø72,5
1x45°
M16
10
12
ø67
15°

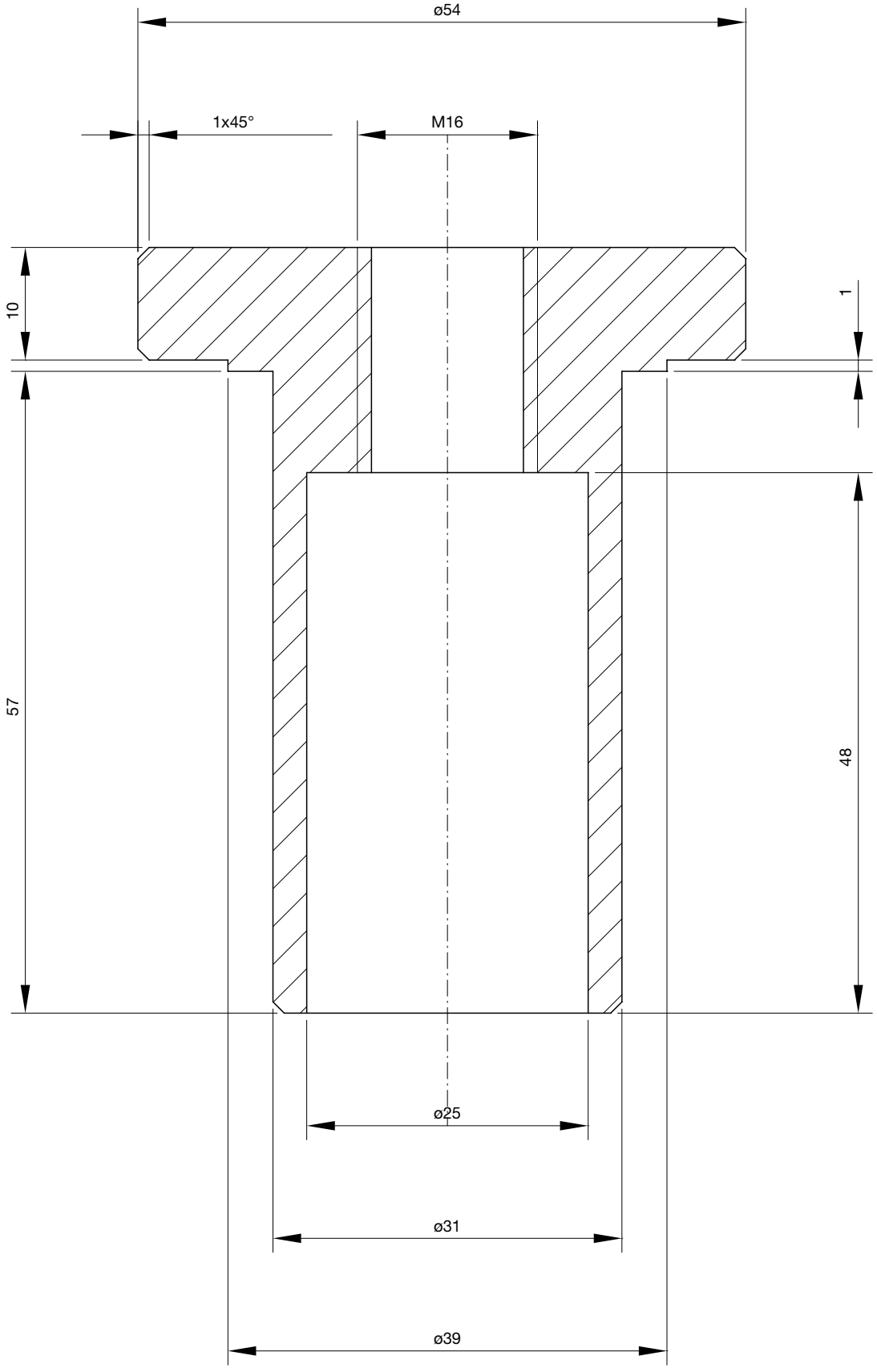
T3


ø90
1x45°
M16
10
10
0,5
ø56
ø79

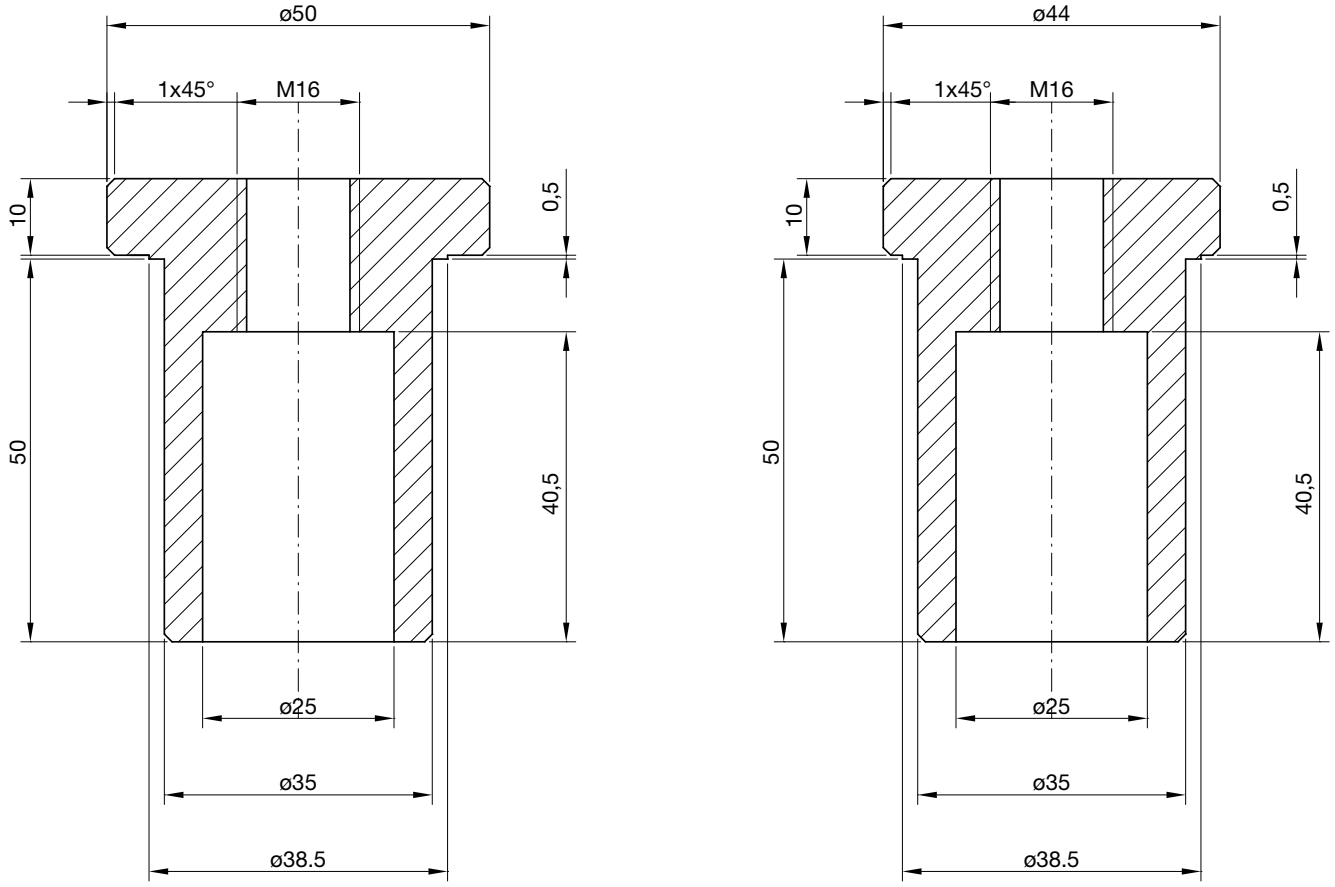
T4



T5



T6


ø50
1x45°
M16
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0,5
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40,5
ø25
ø35
ø38.5
ø44
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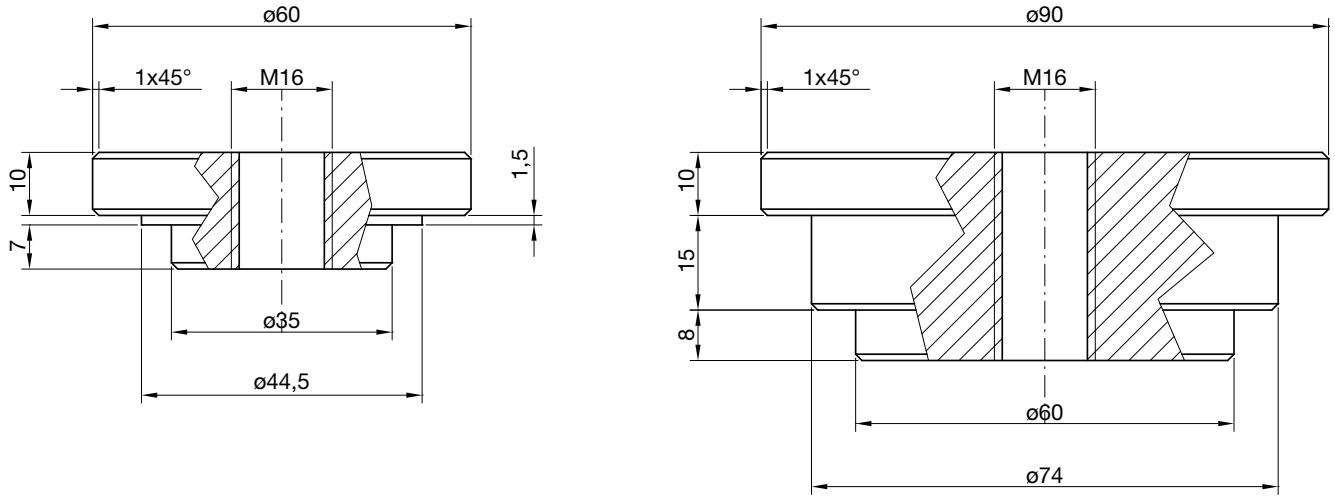
M16
10
0,5
50
40,5
ø25
ø35
ø38.5

T7


ø60
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M16
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1,5
7
ø35
ø44,5
ø90
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M16
10
15
8
ø60
ø74

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